Should the Cost-of-Living Index Provide the Conceptual Framework for a Consumer Price Index?

Jack E. Triplett

Brookings Institution

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Introduction

In several countries (the United States, Netherlands, Sweden), the theory of the cost-of-living (COL) index provides the conceptual framework for the country's consumer price index (CPI)—see United States Department of Labor (1997), Balk (1994), and Dalén (1999) . Others reject the cost-of-living index framework—an example is Australian Bureau of Statistics (1997). Rejection of the COL index is also explicit in an RPI advisory committee recommendation in United Kingdom. In still other countries, Canada being an example, official documents for the CPI are ambiguous about the role of the COL index (Statistics Canada, 1995). The international guideline for consumer price indexes, the ILO manual (Turvey, 1989), does not even mention the COL index.

The question has taken on heightened interest recently. Part of the stimulus comes from the European Union's relatively new Harmonised Indexes of Consumer Prices (HICP). For the HICPs, Eurostat has rejected the COL framework, in favour of an "inflation index" (Eurostat, 1999; Hill, 1997). Another stimulus was the Advisory Commission to Study the Consumer Price Index, known as the Boskin Commission. The Boskin Commission recommended that "The BLS [the United States Bureau of Labor Statistics] should establish a cost-of-living index as its objective in measuring consumer prices" (Boskin et al, 1996, page iii).

In the United States, the Boskin Commission recommendation had the effect of confirming the position that the Bureau of Labor Statistics adopted in the 1970s (after considerable debate). Outside the

United States, the report probably had the opposite effect, because the Commission used the COL framework to motivate its estimate of measurement bias in the CPI. Some statistical agencies distanced themselves from the COL concept, which permitted them to contend that the Commission's bias estimates pertained to a concept that did not describe their CPI's. In this, the statistical agencies may have also distanced themselves from their analytical users: Most reviews of CPI's originating outside statistical agencies (in central banks, for example) have accepted the COL index framework. Indeed, most economists accept the COL framework (notable exceptions are Deaton, 1998, and Turvey, 1999).

The international discussion over the use of the COL index framework for a CPI has been conducted mostly among statistical agencies, and has a large number of strands which are difficult to partition into tidy headings. Moreover, the rhetoric of the debate dominates in some ways its substance. Because words often have associations that go beyond their strict meanings, the choice of words in the debate has influenced the acceptability of ideas, and also sometimes obscured the ideas themselves. For this reason, I turn to the rhetoric of the COL index debate in the first section of the paper, before discussing substantive issues.

1. The Cost-of-living Index: Its Definition, Its Rhetoric and Its Content

1.1 The definition

The cost-of-living index is a price index that measures the change in consumption costs required to maintain a constant standard of living. The COL index may be unconditional, including costs of all variables that affect the standard of living, or it may be conditional on some variables that are held constant, or assumed constant, in its estimation.[2]

The theory of the cost-of-living (COL) index originated in the 1920s with Konus (1939). Summaries of its current status are Pollak (1989) and Diewert and Nakamura (1993). As developed by Konus, COL index theory showed that the Laspeyres index number then (and now) in common use has what is now known as substitution bias. Substitution bias in the CPI was discussed extensively in the

United States Congress and the press after the publication of the Boskin Commission report (Boskin et al, 1996), and for the most part the press discussion reflected a surprisingly sophisticated understanding of this index number problem.

The theory of the cost-of-living index applies to an individual consumer. In actual CPI's, aggregate weights are applied to component price indexes (fresh fruit, furniture, and so forth), each of which, in turn, measures the average change in prices faced by members of the group for which the CPI is defined. A CPI constructed from aggregated data implies that some average standard of living across a group of consumers is held constant. This is often rationalised by the analytic fiction of the "representative" consumer, even though theory suggests that unrealistic assumptions are involved in forming any supposedly "representative" consumer.

Although the representative consumer language is convenient shorthand, the aggregate COL index is perhaps better thought of as the average of the COL indexes for each member or household of the index population. For this case, it is natural to think of equal weighting for the aggregate index, which is referred to in the literature as a "democratic index." However, both actual index estimates (for example, Braithwait, 1980, or Blow and Crawford, EJ, this issue) imply "plutocratic" weighting, in which expenditures of the more wealthy of the index population receive larger weight.

COL index theory is worked out for two periods, usually called the base or reference period (normally, but not necessarily, the earlier period), and the comparison period. Even though the theory is defined on two periods, CPIs are produced for many periods. No index number theory, including the "Divisia index," satisfactorily explains a time series of CPIs, rather than two-period comparisons (see Hulten (1973) for the relation between the COL index and the Divisia index). Additionally, COL index theory is erected on the assumption that the consumer's tastes can be held constant over the interval of the comparison; Fisher and Shell (1972) consider the COL index when the consumer's tastes change.

1.2 The rhetoric

In the controversy over the application of COL index theory to the CPI, the rhetorical content sometimes matters as much as the substantive questions. In the definition of the COL index (above), I purposefully used the term "standard of living." One could also say that the COL index holds real consumption constant, which would tie the definition into language employed for national accounts.

The COL index is often described with other words: "constant utility index," "an index that measures the cost of remaining on the same indifference curve," or sometimes "constant satisfaction

In the language usage of most economists, these terms are all synonyms, they are all economists' jargon for saying that the standard of living is being held constant. Consistently, when Blackorby and Russell (1978) consider an index of the standard of living, they mean an index that measures the expenditure necessary to move from one indifference curve to another, prices constant, an index that might also be described as a quantity index of real consumption.

For non-economists, and even for some economists, the words "constant utility" and "remaining on the same indifference curve" have a theoretical or ethereal or perhaps even unrealistic sound about them; they are not words that one would encounter in, say, an ordinary journalistic account of what the CPI is and what it measures. The economists' jargon is sometimes parodied by using the term "constant satisfaction index" (often pronounced with a meaningful vocal inflection). Indeed, the term "constant satisfaction index" is most often used by opponents of the COL index, which suggests its pejorative connotation.

The term "standard of living," on the other hand, is used by economists and non-economists alike. There is no discernible difference in the technical and nontechnical employments of the term "standard of living." Both economists and non-economists behave as if "standard of living" conveys something that is meaningful, realistic, and concrete, and "standard of living" is never used with any pejorative association implied or intended. Of course, economists know that the *concept* of the standard of living is just as abstract and just as nonobservable as the concept of utility, and poses equal problems that limit practical

measurement. But those are the economist's technical problems; they do not adhere to the term "standard of living" when that term is used in ordinary communication.

The terms "same indifference curve," "constant utility" and, especially, "constant satisfaction" have emotive connotations that the term "standard of living" does not have. Whether these emotive connotations are misleading or misplaced is beside the point. Expressing an idea with one set of words (constant standard of living) conveys something that is different from expressing it with another set of words (constant utility or constant satisfaction), even though the objective meaning in economics is the same. Paying attention to the rhetoric in which a discussion is conducted is an essential part of communication, especially when economists communicate to non-economists.

Statistical agency rationales for rejecting the COL index mention, at some point, the ambiguity or etherealness of the idea of a constant utility price index, with the implication (and sometimes an explicit claim) that the idea of estimating a COL is both unrealistic empirically and ill-defined conceptually. There is merit to the contention that the COL index is difficult to estimate.

I suspect, however, that statistical agencies would not say anything similar about the idea of a *constant standard of living*, or at least they would not say it for popular consumption. The reason is that the one (constant utility) brings forth negative connotations, and the other (standard of living) does not. If a CPI is not an approximation to a COL index, then it does not, *by design*, attempt to hold constant the standard of living. Most users will not understand that when an agency says it is not, *by design*, trying to approximate a COL index in its CPI, its also saying that it is inappropriate, conceptually, to compare the change in consumer expenditures with the CPI and to infer whether real consumption has gone up or gone down. Moreover, I suspect that if this relation were explained to them, some (at least) of the public, non-economist, opposition to the concept of the COL index would evaporate.[3]

For the foregoing reasons, I prefer to say that the cost-of-living index measures the cost of holding the standard of living constant. First, that is technically correct. Second, it communicates an idea to the

largest number of people in the plainest possible way. To the extent that economists' jargon causes communications problems, I opt for other language that communicates more effectively. Third, it promises a salutary reduction in the level of rhetoric that has accompanied this debate.

1.3 The content

The substantive content of the theory of the COL index derives from a simple axiom: *The economic concept of consumption drives reasoning about consumer price index issues*. This was indeed the unique intellectual advance provided by Konus (1939). Previously, reasoning about index numbers revolved around a small set of more or less mathematical properties of different index number formulas (as typified, for example, by the exchanges between Fisher, 1921 and Walsh, 1921).

Although substitution bias is the best known part of the content of COL index theory, substitution bias is only one issue for which COL theory can be employed in reasoning about CPIs. Substitution bias is not so much the content of COL theory as a concrete application of the theory to a particular (and in a sense, narrow) problem—determining the aggregate CPI index number formula.

Constructing a CPI is not just a matter choosing a formula that combines the detailed component indexes—price indexes for coats and carrots and computers and cars, indexes that are sometimes called "elementary aggregates." Hundreds and perhaps thousands of decisions must be made in measuring those detailed component indexes. Those decisions are not solely statistical or sampling or collection and processing decisions. Many of them involve economic questions—they are "what do we want to

Applying the theory of the COL index to the CPI means that those "What do we want to measure?" decisions are guided by a consistent, overall decision-making framework, which is the economic theory of consumption. Using the theory of consumption makes constructing price indexes an exercise in "applied micro theory," comparable to the use of consumer theory for estimating consumer demand, or for the analysis of regulations, or for tax policy analysis, and so forth.

Any use of the theory of consumption, including its application to the CPI, raises some issues that are well known to economists. One set of questions concerns whether the theory is realistic—do individual consumers behave as consumer theory suggests? Do they actually respond to relative price changes by substituting among commodities? A second set of questions concerns aggregation: Even if individual consumers do behave as the theory suggests, does the theory adequately describe aggregate consumer expenditures, and therefore the aggregate cost-of-living index?

Aggregate Expenditures and COL Index. With respect to the second set of questions—the interpretation of aggregate consumer expenditures—theory says that the conditions for aggregating individual demands (that is, for aggregation over consumers) are very restrictive, and not realistic. This means that one cannot necessarily interpret aggregate consumption data as if the aggregate were generated by the behaviour of individual consuming units. In particular, changes in aggregate consumption shares by commodity may be generated by changes in the income distribution, and not by changes in relative prices alone. This has implications for aggregate COLs or CPIs. Angus Deaton (1998, pages 37-38) has recently written:

> "[I]t is unclear that a quality-corrected cost-of-living index *in a world with many heterogeneous agents* is an operational concept" (emphasis supplied).

Yet, one must always balance any theoretical shortcomings with the theory's usefulness. Someone once remarked that the major substantive content of consumer demand theory is that demand curves slope down—consumers demand more of a commodity when its price falls.[4] Empirically, the evidence is overwhelming that demand curves do slope down (see the extensive review of studies of commodity demand in United States Department of Labor, Bureau of Labor Statistics, 1997).

If demand curves slope down, the equivalent proposition for the cost-of-living index is that consumers substitute in response to relative price changes. At the level of the roughly 200-600 commodities that receive consumption weights in the typical CPI,[5] the empirical evidence is overwhelming

that the commodities that have the fastest growth rates are those whose relative prices fall. At this level of detail (that is, roughly 200-600 commodities), commodity substitution exists, and accordingly, the commodity substitution portion of COL index theory is consistent with empirical evidence, for the limited purpose of analysing fixed-weight indexes with 200 or so commodities.

Furthermore, estimates of substitution bias in consumer price indexes are remarkably similar, no matter what estimation methods are used, what time period is explored, or what countries' data are being examined.

One could debate whether the commodity substitution that is in fact observed at the aggregate level is substitution that holds a consumer's standard of living constant. Indeed, this is precisely what is debated in the consumer demand literature. Even here, there is at least some empirical evidence in favour of the aggregate interpretation of the theory. Manser and McDonald (1988) tested whether the conditions were met for interpreting aggregate movements in consumer demand as if they were generated by a representative consumer, and could not reject this hypothesis—their data contained around 100 commodities.

A qualification concerns the level of detail. Even though the empirical evidence is overwhelmingly in support of the predictions of the theory, any theory of consumer behaviour is not pushed very hard when tested at the level of 200 or even 600 commodities. At this level, these are already aggregations of commodities, and not the detailed commodities on which consumers make choices (and of course, the data are also aggregated over consumers), so the power of any test that one could conduct on the theory's predictions will be low. Too little of consumers' real behaviours are apparent in such aggregated data.

The micro level. The really important and relevant issues--quantitatively--in measuring CPIs concern how one measures the detailed indexes. Consumption theory is pertinent and useful for making decisions about measuring the individual commodity price indexes that make up a CPI—deciding how to handle quality changes, new products, changes in transaction terms, multipart pricing, and so forth. Pollak

(1998, page 75) remarked: "In the case of the CPI, economists and others often appeal to the theory of the cost-of-living index for a principled resolution of technical issues."

This takes us back to the first question from the beginning of this section: Do individual consumers (or, more relevantly, households) behave as the theory suggests? Do they in fact optimise? Do not micro-studies of individual behavior provide evidence that is inconsistent with consumer theory?

No economist can be unaware of criticisms of consumer theory. Indeed, anomalies in consumer behaviour, anomalies that are not consistent with theory of consumption, are well known. Thaler (1991) is prominently associated with this strand of research. My impression is that the most telling anomalies arise in choices involving risk, uncertainty, and the valuation of options; perhaps people process information about risk incorrectly, or perhaps the theory of how they should behave in risky situations is wrong. Behaviour toward risk affects consumer choice outside of such obviously risky activities as gambling and insurance (buying a used car, for example), but anomalous behaviour toward risk does not seem central to the application of COL index theory to the CPI.

Looking at anomalies can help focus effort on improving and extending the theory to make it useful for dealing with behaviours that the simple theory does not confront satisfactorily. It was certainly true that the specification of consumer behaviour that Konus (1939) introduced into the index number literature was a very simple specification of the theory of consumption. It was advanced for its day, but it is not advanced now. The simple theory does not say much, for example, about how the consumer gets information to make choices. Information has been incorporated into economic theory since at least Stigler (1961); attempts have been made to bring the acquisition of information (consumer search to find the lowest prices, for example) into the theory of the COL index, but it is not easy—see the discussion in Pollak (1998), and also Baye (1985) and Triplett (1998).

The analysis of quality change is another topic that is not handled well by the simple theory of consumer behaviour that was known in Konus' day. A theory of consumer behaviour toward the

characteristics of goods, rather than the goods themselves, is extremely complicated. An early example is Court (1941a, 1941b). Other contributions include Ironmonger (1972) and Lancaster (1971). A recent extension that is directly relevant for analyzing quality change in price indexes is Berry, Levinson and Pakes (1995). Pakes (1997) presents a nontechnical summary of some of this work, discusses its application to the CPI, and unresolved problems.

Even so, the application of characteristic-space consumer theory to COL indexes is inadequately worked out. My own work (Triplett, 1983b, 1987) makes use of simplifying assumptions that make it a special case. Pollak (1989) contends that there are many special cases, and that it will be difficult to find a general case that is tractable for empirical work.

Aggregation issues, discussed in the previous section, arise here also. There are many consumers, and they evaluate quality change differently. Yet, in the CPI it is necessary to make one quality adjustment when quality change is encountered, essentially because only one price index for, say, automobiles is calculated, and not specific automobile price indexes for each consumer or each consumer type. This means that quality change is handled in practice as if there is a representative consumer, whose valuations of quality change are incorporated into the CPI, and the representative consumer is a very questionable concept.

It would be wrong to say that modern theory resolves all the problems with which we must deal, but it is also quite wrong to say that there is nothing in the modern theory that confronts the problem of quality change in price indexes, as I interpret Turvey (1999) as asserting. Turvey (1999) and I might agree that we need an improved theory, but he overstates his case, by a large margin, when he implies that consumption theory contains nothing that is relevant.

It is certainly true that, in many other ways, the theory has not advanced enough, and in many ways COL index theory does not confront, fully, some of the problems for which CPI compilers most need guidance. Pollak (1998, pages 69-70) wrote: “To deal with current concerns about the CPI within the

framework of economic theory requires developing the theory of the cost-of-living index under more general assumptions than have thus far been standard."

There is also the perennial question of the realism of the theory's assumptions. Economists know that the theory of the cost-of-living index, like any theory, rests on assumptions that are often (or, more accurately, often seem) unrealistic. Realism objections are quite old. For example, when Friedman (1938) raised the substitution bias issue with respect to the fixed-weight indexes of output and productivity constructed by Copeland and Martin (1938), the authors dismissed this as more or less an academic curiosity. Theory always abstracts. Krugman (1998, p. 19) has noted that "Economic theory is...a menagerie of thought experiments—parables, if you will—that are intended to capture the logic of economic processes in a simplified way." That is often lost sight of in criticisms that confuse descriptive usefulness with analytic usefulness. The issue is the analytic usefulness of consumer theory, and not whether one can find some consumer behaviour that the theory (as presently developed) cannot explain.

Moreover, the debate on COL index theory often reads as if the statistical agency contributors thought that the only practical application of consumption theory was to the COL index. It is important to recognise that economists use the theory of consumer behaviour in all kinds of practical applications, demand analysis, tax analysis and other issues of public policy analysis. It would be hard to describe the life of an economist working in those areas who was told—as Turvey (1999) instructs CPI compilers—to ignore the theory of consumer behaviour. Those economists also know of the shortcomings of the theory for applied problems. But it is useful, extremely so, and so it is used. The same thing can be said of the theory of the COL index: It is useful, and it is used (it is even used sometimes when the agency officially says it is not computing a COL index). Fully adequate or not, it is the only thing we have.

1.4 What is the alternative to the COL index?

In section 1.3, I stated that in my view "COL index theory" means mainly that the economic concept of consumption drives reasoning about consumer price index issues. Opponents of the COL index

framework have not described cogently the conceptual framework they advocate as an alternative. The Laspeyres index is a weighting system, it is not a conceptual framework for resolving issues on how the construct, e.g., elementary aggregates in the CPI. Opponents more or less construct an argument against the COL index, they take "not COL index" positions. They point to problems or alleged problems with COL index theory, implicitly on the logic that the alternative to the COL index then wins, by default. Examples are Hill (1997) and Turvey (1999).

To conduct a meaningful debate, one needs to understand whether alternative conceptual frameworks for the COL index are less ambiguous or less problematic, are more consistent with empirical knowledge, or provide more efficient tools for resolving practical problems that arise in estimating the CPI. If those "not COL" frameworks were carefully written down, one could compare the strengths and shortcomings of the COL and "not COL" conceptual frameworks.

In an internal Office for National Statistics paper, Holloway (1999) sets the COL index at one end of a continuum. She puts at the other end of the continuum "not COL" (or alternatively, "pure price [6]). On her interpretation, "Anything which relates to consumer preferences [and] behaviour . . . moves a pure price index toward a cost of living index." With this continuum idea, she deduces that "not COL" at the other end of the continuum must be a price index in which consumer preferences and behaviour *have no place* in the measurement. For example, consumer expenditures are the end product of consumer behaviour. In Holloway's definition of the continuum, even using consumer expenditure weights introduces an element of consumer behaviour, and therefore an index that uses consumption weights is not at the far end of the "not COL" continuum.

I suspect that statistical agencies that advocate "not COL" for their CPIs will not accept Holloway's description of the continuum. For most of them, "not COL" probably means a fixed-basket, Laspeyres index. However, Holloway's paper suggests that people of that persuasion have already let the camel's nose into the tent. Once you accept consumer behaviour with respect to the weights as

appropriate for the CPI, why stop there? Why not admit some other form of consumer behaviour into reasoning about the index? What indeed is the stopping rule on Holloway's continuum if one does not want to be at either the COL or the "no consumer behaviour at all" poles?

In summary, a useful dialog on the question of the economic concept underlying the CPI requires considering alternative concepts, not just finding weaknesses in one. When a statistical agency rejects the COL index as the economic concept for its CPI, it needs to understand the implications of the alternative, "not COL" index.

2. The Domain of the COL and of a CPI

It is sometimes said that a COL index would include variables, such as nonmarket goods and services and environmental amenities, that are included in no country's CPI. The implication is that moving to a COL index concept would force inclusion in the CPI of components whose measurement is contentious and possibly not germane to some index uses.

I define the "domain" of the CPI as the list of the *n* goods and services in a typical country's CPI:

(1): domain of the CPI = $[x_1, x_2, ..., x_n]$

Note that this list of *n* commodities is generally much larger than the number of component indexes (sometimes called "elementary aggregates") in any country's CPI, because agencies always base their CPIs on samples of the *n* goods and services in the domain, and index samples group commodities (fresh fruit, for example).

The COL index holds constant the reference period's standard of living. The domain of the COL index depends therefore on the list of commodities that determine the standard of living.

The list of commodities (perhaps I should say the list of variables) that determine the standard of living is broader than the domain of any country's CPI. The standard of living cannot be defined independently of government provided goods and services, of the level of pollution, or of crime and safety.

The Boskin Commission had a long list of "broader considerations on the quality of life" which the Commission included in its notion of what the CPI should measure.

Accordingly, the domain of a *comprehensive* COL index might be written:

(2) Domain of the COL index = $[x_1, x_2, ..., x_n; y_1, y_2, \ldots, y_m]$

This is just a formal statement that there are some variables, [*y*], that would be included in a comprehensive measure of a COL index but that are not normally included in a CPI.

Pollak's concept of the COL "subindex" (Pollak, 1989) provides the way to think about the COL index domain and how to connect the domains of the COL index and the CPI. A subindex could be familiar intermediate-level CPI indexes such as food or clothing.

Pollak (1989) went on to note that the entire CPI, as every country publishes it, is also a subindex of the cost-of-living index. Suppose that the domain of the CPI, the [x] variables in equations (1) and (2), includes all market purchased consumption goods and services. Then, following Pollak, we can say that such a CPI is an approximation to the COL *subindex* on market-purchased goods and services. Indeed, similar language has been used to describe the domain of the COL index that provides the conceptual framework for the United States CPI.

The theoretical conditions for producing subindexes are quite stringent. For example, a subindex of the COL index that is restricted to market-purchased goods and services requires that trade-offs between, say, expenditures on door locks and burglar alarms compared with, say, garden parties (all of which are inside the subindex), do not depend on the level of police protection (which is outside the subindex).

The subindex idea makes it clearer what we are doing when we compute a CPI that depends only on market purchased goods and services. Surely, for example, when police protection declines the displacement of expenditures on garden parties in favour of expenditures on locks and burglar alarms does not leave the standard of living unchanged. The CPI on market purchased goods and services must

maintain the assumption that it does. The theory of the COL subindex makes the limitations of an actual CPI index clearer by making its assumptions more transparent.

With the concept of the subindex, there is nothing inherently inconsistent in saying that one wants to adopt a COL index concept and also wants to restrict the CPI to market-purchased goods and services. For this case, the CPI is an approximation to the COL subindex on market-purchased goods and services. Or, to put it another way, the CPI is a price index for that part of the standard of living that arises from market-purchased goods and services.

Saying it this way, defining the domain of the COL subindex this way, makes more clear some of the uncomfortable boundary issues that arise in a COL subindex defined on market-purchased goods and services. A "non COL" index approach leaves the same boundary issues equally unresolved, but it covers them up. An arbitrary boundary tends to hide the measurement shortcomings inherent in defining the living standard to include only market-purchased goods and services.

Another valuable use of the subindex idea is closely related. Suppose we were to agree that, ultimately, we want a COL on all of the variables, x and y. It will always be the case that measuring some of the y variables is not feasible, or that the methods to measure them are too "soft" to be defended except as a research exercise. In other cases, the variables themselves may be too controversial for widespread public acceptance. If for any of these feasibility or acceptability reasons we decide against including, say, measures of y_r and y_s, this does not preclude doing a COL subindex on the others. That is, we can compute a COL subindex where the domain is:

(3) domain COL subindex = $[x_1, x_2, ..., x_n; y_1, y_2, \ldots, y_m - (y_r, y_s)]$

Again, this subindex idea does not mean that excluding y_r and y_s poses no problems. It does give a consistent way to characterise what is done and to consider, properly, the limitations of the subindex that arises from excluding costs of variables y_r and y_s. It is tremendously useful to have such a conceptual way to describe the measurement and also to characterise its strengths and limitations.

In summary, adopting the COL concept as the framework for the CPI does not necessarily require that a statistical agency estimate costs for all variables that might conceivably be put into the standard of living. Use of Pollak's concept of the subindex can permit introducing feasibility and user acceptability as considerations in defining the domain of the COL subindex that one wants to approximate in the CPI, or indeed in a research price index.

3. The COL Index: Inflation Measure or Escalator?

An old theme in the price index literature concerns the relation between the design of an index and its intended use. The CPI is used as an escalator for wages or income payments. The CPI is also a measure of inflation for households. It has frequently been asserted that the COL index is the appropriate measure for escalation, or compensation for inflation, but that the COL index is not appropriate if the objective is measuring inflation.

In this section, I contend that the existing price index literature has it backward—the COL index is an appropriate concept for measuring inflation, but it is not *necessarily* the measure that suits the escalation or compensation problem that is faced in public and private escalation arrangements.

3.1 Inflation Measure: COL Index or Laspeyres Index?

Two papers by Hill (1997, 1999) have contended that consumer inflation must be measured with a Laspeyres (fixed weight) index and that a COL index is not suitable for this purpose: "A cost of living...index does not measure the change in the value of a fixed basket of goods and services so that its meaning as a measure of price change is not self evident" (Hill, 1997). Hill also writes: "...An increase in the 'level of prices' suggests measuring inflation by the increase in the total monetary value of a specified, fixed set, or 'basket,' of goods and services...." Following Hill's intellectual leadership, European HICP indexes have been designated explicitly as indexes of consumer inflation, and not COL indexes.

Hill *asserts* that the Laspeyres is the appropriate measure of inflation, he does not develop a case based on analytic arguments. However, central banks and economic policy makers who are concerned with inflationary policy do not agree with Hill's views.

In the United States, the central bank publicised shortcomings of the CPI as a COL index. Reviews by central and regional Federal Reserve staffs adopted the COL framework (Wynne and Sigalla, 1993; Lebow, Roberts, and Stockton, 1994; Shapiro and Wilcox, 1996). None suggested in any way that the COL framework was inappropriate for monetary policy.

Reviews of CPIs carried out by central banks in other countries have also adopted the COL framework. Examples are Oulton (1995) and Cunningham (1996) for the United Kingdom, Shiratsuka (1998) for Japan, Hoffmann (1998) for Germany, and Ruis-Castillo, Ley, and Izquierdo (2000) for Spain. A paper prepared by the Bank of New Zealand for that country's review of its CPI states: "The theoretical roots of the CPI are found in the literature on cost-of-living indexes." The New Zealand paper goes on to conclude that for both inflation measurement and money policy uses of the CPI in New Zealand, "The implied measure of CPI inflation is an increase in the cost-of-living or cost of consumption, henceforth referred to as consumer price inflation" (Connolly, 1996). The head of the New Zealand central bank has as an inflation target written into his "job description," so the measure of consumer inflation that is appropriate for monetary policy--of concern to central banks everywhere--has immediate and substantial relevance to the administration of the country's central bank. Hoffmann (1998) documents that the German Bundesbank has for many years considered probable biases in the CPI in setting its inflation target, a position that implicitly accepts the COL index as an inflation standard (because no other standard exists for evaluating biases in CPI indexes). In personal conversations, economists in the Bank of Australia described removing mortgage interest from the CPI as an important issue (so the inclusion of mortgage interest in a user cost measure for housing was undesirable for a CPI for monetary purposes), but otherwise, making the CPI approximate a COL index was not objectionable.

In a survey, the Organization for Economic Co-operation and Development (1997), noting disagreement on whether monetary policy demands a COL index, lists eight countries where policy makers responded affirmatively (United States, Germany, France, United Kingdom, Netherlands, Norway, and Sweden). Disagreement was registered "most often [by] national statistical offices" including France, Finland, Sweden, Austria, Belgium, Greece, Ireland, New Zealand, and Switzerland. Note the inclusion of some countries on both sides of the question, reflecting disagreement by statistical offices and monetary authorities in those countries.

Additionally, I think it relevant to note that I have experience in an anti-inflation program. In President Carter's Administration I was Assistant Director for Price Monitoring at the Council on Wage and Price Stability. None of the top administrators at the Council questioned the concept of the COL index, and indeed two of us (myself and Deputy Director R. Robert Russell) had published on the topic.

In summary, the appropriateness of the COL index concept for monetary policy is questioned by statistical some agencies but not by central banks and economic policy makers. To be specific, Hill's (1997, 1999) views on an inflation index are not shared by central bankers, economic policy makers, and administrators of anti-inflation policies.

Indeed, one can make a good case that the COL index is exactly what is wanted as a measure of consumer inflation. The COL index is a welfare-oriented measure, it is the price index that holds constant the standard of living between two periods. If the "not COL" index deviates from the COL index, it must not hold the standard of living constant, so the not COL index must change when some component of the standard of living changes. Why monetary authorities should want to stabilise an inflation measure that incorporates increases or decreases in the standard of living (as does the "not COL" index) is not clear. Stabilising such an inflation measure might imply a falling standard of living, which would correspond to no central banker's objective.

Consider an example. Suppose two commodities in a CPI, A and B, corresponded to very close substitutes. Now suppose that the price of A accelerated strongly (for cost-side reasons) relative to B, which implies that consumption of A falls substantially. In the Laspeyres index, A retains its base-period weight, so its relative price increase is fully reflected into the index, even though its current period share is small and consumer substitution toward B means that welfare has not greatly changed, as the COL index would indicate. Surely the monetary authorities would not want to stabilise a Laspeyres index in this situation, because stabilising the Laspeyres index implies diminishing the living standard. The example is, no doubt, unrealistic (for one thing, very close substitutes would probably be put into the same CPI elementary aggregate), but the principle illustrated is compelling.

Thus, if a central bank sets a zero inflation goal, the COL index serves as an appropriate *standard* for determining whether or not the goal has been met. There are issues yet to be resolved, and policy makers do not always have the same views, but the fixed-weight index number question raised by Hill is not an issue.

3.2 Issues for a Monetary Policy Index.

What index should a monetary authority stabilise? As the thoughtful contribution of Goodhart (2000) shows, this is by no means a settled issue. At least three questions arise. Should it be a one-period COL index (which is one way to characterise the question of including asset prices in the index)? Does the COL index provide all the information necessary for stabilisation? And should the stabilisation index be a consumer inflation index at all?

Taking the last question first, Blinder (1997) notes that economists do not have very good estimates of who bears the cost of inflation, but that much current thinking about it suggests that inflation produces inefficiencies in business decision-making. If that is so, Blinder contends, consumer inflation may not be the appropriate objective of an anti-inflation policy. Instead, one might stabilise the price index that influences business decision-making. That might, coincidentally, be the CPI, but not necessarily.

Goodhart (2000), another economist with central banking experience, pursues a similar objective, in searching for the index that is most closely related to losses in output from inflation. Inflation has a welfare cost, as does the anti-inflationary policy adopted to contain it, and the price index that the monetary authority is charged with stabilising might reflect those welfare costs in some manner.

On the second point, there is a difference between information that the monetary authorities might need to monitor, predict or forecast future inflation and the *standard* for determining whether a central bank has met its zero inflation goal. As noted in section 3.1, the *standard* might be the COL index. Alternatives might be one of the non-consumption indexes suggested by Blinder (1997) and Goodhart (2000).

On the other hand, monitoring, forecasting, and analysing inflation requires much more information about price movements and determinants than one could get from the aggregate COL index, or any other index. One might need a set of "leading indicators" for inflation. Wage measures often serve this function. Conversely, the idea of "core inflation" suggests a narrower focus.

The need for additional information for monitoring inflation, or for forecasting it, does not invalidate the COL index as the standard for anti-inflationary policy. It is a bit surprising that these two ideas have become confused.

Finally, should the standard for "zero inflation" be an index that is broader than the COL index (to include investment goods, internationally traded goods, or asset prices)? It has been asserted that the success of a central bank's anti-inflation policy should be judged by inflation in the entire economy, and not just in the consumer sector. Among asset prices, inflation in house prices is often mentioned.

Suppose that price indexes for investment goods, correctly measured to account for changes in the productivity of those goods, increased forever at 10% per year, but that consumer prices, measured by a COL index that corrected for quality change, showed zero inflation. Why should the monetary authority

care, for its anti-inflation program? If there were never any feedback in the consumer sector, there is no reason to consider inflation in the investment goods part of the economy.

The reason the monetary authority would in fact care about investment goods is different: Price increases in investment goods will eventually feed back into future consumer inflation. Asset prices may provide information necessary for monitoring, forecasting, and predicting inflation. Ignoring the warning signs in the non-consumer part of the economy would not be prudent. But that does not make investment goods prices part of the stability criterion; instead, they are being used as forecasters of the future change in consumption prices. In the end, other prices only matter for anti-inflation policy if they ultimately feed back into consumer prices (which of course normally they will).

In summary, the COL index is a welfare-type measure. It is very hard to understand why a monetary authority should be interested in stabilising something that is not a welfare measure. As the standard for anti-inflation policy, then, I believe the COL index is exactly what is wanted, though there may be other welfare-type measures that have a claim on our attentions. Certainly, however, the COL index is not the only price information needed for anti-inflationary economic policy.

3.3. The COL index as an Escalator

In Triplett (1983a), I suggested that escalation uses of the CPI do not necessarily imply a COL index. Briefly, the argument goes as follows.

Escalation is generally applied to income payments, such as wages or pensions, so it is natural to think of the COL index as the escalator that would hold the living standard constant. But escalation is never applied to *total* income. Many recipients of wages or pensions have other sources of income. Escalation of one component of income by the COL index does not necessarily hold the living standard constant, it depends on what happens to other components. I think this is the reason why few parties to escalation pay much attention to the methodology of the index they build into their agreements, and it probably explains as well why 100% escalation is so rare in private sector agreements.

Alternatively, we might define the purpose of escalation as leaving the income *payment* with the same command over goods and services as it had in the base period. This is not the same objective as holding constant the standard of living of pension recipients. Same command over goods and services implies a measure of inflation, or a deflator for consumer purchases, which in turn implies the COL index. But that is because the COL index is a measure of *inflation*, not because the COL index provides an escalator that holds constant the incomes of pension, or wage, recipients. It is a subtle distinction, perhaps, but as an important one. The objectives of an escalation policy (for pensions, for example) are seldom thought through.

More information is in my original article (Triplett, 1983a). A very thoughtful and insightful discussion of the escalation of pensions is Griliches (1996).

4. Some Concrete Issues

Does the COL index framework give different answers in practical situations from the "not COL" framework? One great difficulty in answering this question is the lack of a concrete and explicit "not COL" framework that would give clear alternative prescriptions for the CPI.

Additionally, some of the examples that have arisen in international statistical agency discussions reflect misunderstandings of what COL index theory says. It might be useful to catalogue such errors, essentially to eliminate confusions and to clarify the real issues, but this is not the place for that.

4.1. Owner Occupied Housing and the CPI

Beyond the rhetoric, the issue that drives much statistical agency uneasiness over the concept of the COL is the treatment of owner-occupied housing. COL index theory suggests pricing the flow of monthly housing services—the monthly cost of living in the house. It is perhaps an oversimplification to say that empirical problems in estimating the flow of services for owner-occupied housing have induced rejection of the COL index framework, but there is nevertheless considerable truth in the oversimplification.

The concept of consumption implies that the standard of living depends on the consumption of housing services, and not on the purchase of houses. I think that is not controversial, even among detractors of COL index theory.

For rental housing, the price and the quantity are clear. The monthly quantity is the use of an apartment (flat) or house of a particular specification (location, size, amenities, and so forth); if only one dwelling is used by a household, the change in the quantity of housing consumed is identical with the change in the quality of the dwelling unit. The price is the monthly rent. Measuring rent change is certainly not free from empirical problems—for example, Randolph (1988) shows that price indexes for rental housing have a substantial downward bias because of unobserved ageing effects, even if other attributes of the dwelling are held constant.

In the case of owner-occupied housing, the quantity is in principle the same as for the rental housing case, the use of the dwelling for a month. But there is no transaction between the owner of an owner-occupied house and the tenant. There is no directly observable price, and also no directly observable monthly or annual expenditure weight. Two empirical approaches exist.

Rental equivalence. In the rental equivalence approach to owner-occupied housing, one estimates the *change* in monthly cost for owner occupied housing by the *change* in monthly rents for housing of similar types that are in fact rented. Three strong objections to the rental equivalence procedure arise.

In the first place, in many countries rent control and publicly subsidised rents are prominent. For this reason, changes in rents may not measure very well monthly dwelling costs for owner-occupied dwellings. This is a serious problem.

Second, it is sometimes said that owner-occupied and rental housing are different markets and their prices do not move together. However, in the absence of rent controls and similar regulatory distortions or nonmarket determined rents, evidence suggests that rents—though they differ substantially in

levels—tend toward similar rates of change within a particular urban area, whether single family or multifamily, and for inexpensive and expensive housing. The second objection is valid mainly when the first one (rent control and so forth) creates problems.

A third objection is that the rental market is "thin." Usually, this actually means that the rental market is thin for the *exact type* of housing that is owner occupied. If the rental market is thin for the *exact type* of housing that is owner occupied, then the observation that rents in a particular urban area tend to move together also suggests that, thin or not, an index of rents, suitably partitioned or segmented, will provide a useful measure for owner's equivalent rent. If the objection just means that rental sample sizes are too small, then they should be too small to compute a rent index; most countries include rent in their CPIs. In the absence of rent controls and publicly subsidised housing, this objection has less force.

It is sometimes said that pricing owner-occupied housing with the rental equivalence method is an imputation, and that imputations should not appear in a CPI. It probably is an imputation, but this contention seems largely rhetorical. For example, in the HICP the "no imputations" rule has been used to exclude imputing rent change for owner-occupied housing from rent changes in the rental housing market. But the HICP contains an imputation in the case of insurance, where the pricing concept and the weight is the imputed services of *administering* an insurance policy, and not the service of insuring the policy holder. There is no price for an insurance administration service so defined, no market transaction in such services, and no separate way to estimate consumer spending on such a service. In contrast, a rental equivalence price is a market price, it is not an imputed *price*; it is only imputed to a closely related commodity to that for which the price is collected. The insurance imputation is acceptable because it is not called an imputation, but it is an imputation nonetheless.

The question is not whether the price is imputed, but whether the occupants of owner-occupied housing are affected by inflation in the housing market, and if they are how should we measure inflation for this portion of the CPI population.

User cost functions. A second way to estimate the cost of owner-occupied housing is to make use of a relationship from capital theory that relates the price of houses, the cost of providing housing services, and the market rent:

(4) $c_t = (d + i) P_t - (P_t - P_{t-1})$

In this equation, c_t is the monthly *cost* of providing housing of specified characteristics, P_t is the price of the house itself, d is the rate of depreciation and i is the appropriate interest rate for housing investment. The term $P_t - P_{t-1}$ is the capital gain (or loss) from holding the property for one period. For simplicity, I have ignored property taxes and maintenance and repair expenses in equation (4) because they are normally measured directly in CPI's and because their effects on cost are obvious. In equilibrium, c_t, the cost of housing, as defined in equation (4), is equal to the competitive market rent, r_t.

The user cost equation offers an option if one believes that the rental housing market is too unrepresentative to provide a good estimate of the cost of owner occupied housing. Unfortunately, existing estimates of user cost for housing are often far more volatile than market rents suggest (the best analysis with respect to the consumer price index is Gillingham, 1983). The basic reason is that capital gains, which in equation (4) reduce the cost of providing housing, are volatile, and when capital gains are high (which will happen when house prices are accelerating), they may be large enough to create negative user cost. CPI users are not likely to accept a cost function that shows negative monthly costs of housing precisely when inflation in house prices is the highest.

Another objection to user cost functions comes from central banks, who seldom like to see the price they control (interest rates) included in the CPI (Stott, 1998). When interest rates are a main instrument of anti-inflation policy, this concern is understandable, even though it remains true that interest is a major part of the cost of consuming the services of durable goods, especially those that are long lived. Moreover, it is quite clear from housing market data that the short term movement of rents is nowhere

nearly so volatile as a user cost function (with current mortgage rates) suggests, which validates from a different perspective the dislike of central bankers to see the price they control increasing the CPI.

Turvey (1999) opposes the flow of services approach for owner-occupied housing. His argument contains two surprising errors. "To ignore the actual prices of [durables] in favour of their imputed rental values...would not appear sensible to most economists." Equation (4) shows that the selling price of a durable good is included in the user cost expression; the actual selling price is hardly ignored. The sentence quoted sets up a false relationship that misconstrues the issue.

Another slip in Turvey's argument is even more surprising: "Most people will judge it as absurd to regulate Social Security benefits, pensions and taxes according to...the amount consumers are deemed paying themselves for the use of their owner-occupied dwellings...." Here, Turvey confuses the *measure* of inflation with the important issue of which income flow should be adjusted to compensate for inflation.

Owner-occupiers have an implicit flow of income from their owner-occupied housing (this is the treatment in national accounts). Thus, a pensioner's *total* income may include pension and nonpension income. To adjust pension income by a COL index that includes the cost of owner-occupied housing--ignoring, that is, the fact that pensioners have implicit income from housing--will of course leave those individuals at a higher standard of living, whenever the price of housing is growing faster than other prices. This point was made in my old paper (Triplett, 1983a). It is not an argument against measuring inflation by the COL index, or against measuring housing by a flow of services approach; it is, rather, one of the many arguments that can be levied against the use of 100% escalation in income payments. See the cogent discussion of this problem by Griliches (1996).

Other alternatives. A "not COL" solution sometimes suggested is to include in the CPI only the price change for houses. Equation (4) shows some of the problems with that. For owners, a rise in the price of houses has two effects on the cost of housing. The direct effect raises the cost of housing, because the house price is multiplied by depreciation and interest rates (see the first term on the right-hand

side of equation (4)). But the capital gains effect lowers the cost of housing, through the second term in equation (4). Equation (4) rationalises the widely-observed fact that owners like to see house prices go up, but prospective owners do not (for prospective owners, there is only the direct effect, they do not benefit from the capital gain). Including house prices only in the CPI overstates the cost of housing to owners during a period of rising house prices, and understates it if house prices fall.

Conclusion. In summary, then, the urge to reject the COL index formulation for owner-occupied housing is driven by practical considerations. On the one hand, use of owner equivalent rent is thought to be unacceptable to CPI users (even though it has not remained controversial in countries where it is in place). On the other hand, putting mortgage interest into the CPI, even in the form of a user cost function for housing, is often disliked by central banks who use interest rates as a tool of monetary policy.

There is no fully satisfactory solution to measuring the price of owner-occupied housing. The problem arises because housing is a large proportion of consumption, so it cannot be ignored in the CPI, and because there is no transaction that can be observed for the monthly cost of housing. The problem of owner-occupied housing is not caused by the COL index concept. It cannot be solved by ignoring the concept of the COL index.

4.2. An Second Example

One interesting case where COL index and Laspeyres index formulations seem, under some circumstances, to give different answers involves home heating and cooling.[7] Suppose an unusually cold winter (or an unusually hot summer). Suppose there is no unusual increase in the price of home heating fuel (or of electricity for air conditioning). The unusual weather increases the cost of heating (or cooling) one's home because the quantity consumed increased, not because prices rise. How should we think about what would appear, to most homeowners, as in increase in their cost of living?

In the Laspeyres' index formulation, one simply says: Only price change matters, quantity changes do not matter, the weights for home heating fuel (electricity) are held constant at the base period levels,

and no inflation has taken place. If the objective is to produce an inflation index for monetary policy, one might put this even stronger: One would not want to mistake the effects of a severe winter for underlying inflationary forces.

Yet, if it is not counted as consumer inflation, then the increased consumption of home heating oil must be a rise in the standard of living (it would show up in this way in national accounts, unless offset by declines in consumption elsewhere). This seems questionable, which suggests that the Laspeyres view is not totally satisfactory.

On the COL index view, the situation is more complicated, because the COL view forces one to ask: Exactly what is being held constant? No one wants home heating fuel for its own sake, so what matters to the dweller is the cost of keeping one's home to a comfortable temperature in the winter (which is what the heating fuel was purchased to provide). On this concept of consumption, we might specify that the COL index should measure the cost of holding constant the winter-time temperature in the living quarters of the house; the COL index will then rise with cold winters, and fall with unusually mild ones.

There is another way to look at this. One might want to produce a COL subindex *conditional* on the base period's weather experience (the concept of the conditional COL subindex is attributable to Pollak, 1989). In this case, the unusually cold winter does not affect the *conditional* COL subindex that holds the environment constant. Even though the unusual weather conditions raise, in some sense, the cost of living, they do not raise the COL subindex that we want to measure, which is a conditional COL index. The COL subindex that holds the environment constant is probably the COL concept that is most useful for an anti-inflation policy.

This example shows that the purpose for which one wants a price measure is essential in specifying the nature of a COL index. The COL index framework is a very flexible one. It can be applied in different ways, depending on the purpose.

The real value of the COL index framework is to make us specify more precisely what it is that we want to measure, and to make us state more precisely the question for which we want the CPI as an answer. I am not saying that one could not work out those questions precisely in a non-COL framework. However, having a conceptual framework based on the COL index helps, because asking what conditions "outside" the index are held constant is not a very natural question in the Laspeyres framework.

5. Concluding Remarks

This paper's major themes come from the two questions that opened it. The first question (does a CPI *need* an underlying conceptual framework?) was addressed only implicitly. When price index agencies explicitly adopt the COL index, it is obvious that they do so because they also believe that an underlying CPI conceptual framework is necessary. But even when agencies do not adopt an explicit framework, an implicit framework evolves out of the practical decisions that are made in constructing the index, though it is often hard to discern what that implicit framework is. Neither the Laspeyres index, nor a "fixed-basket" index, nor the idea of a "pure price" index provides an underlying conceptual framework for resolving measurement issues within CPI detailed component indexes. One issue, then, is whether it is better for the underlying framework to be explicit and written down, or implicit.

With respect to the second question, I contend that the theory of the cost-of-living index does provide the underlying conceptual rationale for constructing a practical CPI, for the reasons elaborated in the substantive sections of the paper. I put much more emphasis on COL index theory as a tool for resolving practical index number issues—and much less emphasis on substitution bias and index number formulas—than has generally been the case in the price index literature. The important difficulties in estimating price indexes concern measuring the elementary aggregates—constructing detailed price indexes for coats and carrots and computers and cars. These pose more vital and difficult questions, empirically, than aggregating those components into an overall CPI.

A kind of “two different worlds” syndrome exists in the price index literature. On the one hand, academic contributors are often unfamiliar with the complexities of price index construction, and may underestimate the degree of difficulty in the decisions that go into an actual price index. Perhaps for this reason, they typically are more concerned with index number formulas, which is the topic, after all, that makes up the bulk of the index number literature. Thus, academic researchers are likely to see the COL index in terms of substitution bias, and to underestimate the theory’s contribution for resolving issues that arise in calculating the component price indexes that are aggregated with the index number formula. Statistical agency contributors are more likely to understand the difficulties, and are less likely to put questions such as substitution bias at the forefront of their concerns. For this reason—the COL index usually being presented in terms of the price index substitution bias—they are less disposed to the theory, which seems to them (as it does to some of the academics) esoteric or unhelpful. Because I view both the typical academic and the typical agency positions as partly right and partly wrong, this paper is a contribution toward breaking down the barriers between those two different worlds.

References

Australian Bureau of Statistics. (1997). *Outcome of the 13th Series Australian Consumer Price Index Review*. Australia: Australian Bureau of Statistics.

Balk, B. (1994). "The New Consumer Price Indices of Statistics Netherlands." *Statistics Journal of the United Nations* 11(2): 119-123.

Baye, M. R. (1985). "Price Dispersion and Functional Price Indices." *Econometrica* 53:1 (January): 213-223.

Berry S., Levinsohn, J., and Pakes, A. (1995). "Automobile Prices in Market Equilibrium." *Econometrica* 63(4): 841-90, July.

Blackorby, C. and Russell, R. (1978). "Indices and Subindices of the Cost-of-Living and the Standard of Living," *International Economic Review* 19:1 (February): 229-240.

Blinder, A. (1997). "Measuring Short-Run Inflation for Central Bankers: Commentary." *Federal Reserve Bank of St. Louis Review* 79(3): 157-60, May/June.

Blow, L. and Crawford, I. (Forthcoming). "Substitution Bias in the RPI, a Non-Parametric Assessment." *Economic Journal*.

Boskin, M., Dulberger, E., Gordon, R., Griliches, Z., and Jorgenson, D. (1996). "Toward a More Accurate Measure of the Cost of Living." Advisory Commission to Study the Consumer Price Index. Interim Report to the Senate Finance Committee, December 4.

Braithwait, S. (1980). "The Substitution Bias of the Laspeyres Price Index: An Analysis Using Estimated Cost-of-Living Indexes." *American Economic Review* 70(1): 64-77, March.

Connolly, C. (1996). "The Purpose of the CPI." *The New Zealand Reserve Bank Research Memo* M96/34, July 16.

Copeland, M. and Martin, E. (1938). "The Correction of Wealth and Income Estimates for Price Changes." Conference on Research in Income and Wealth, Studies in Income and Wealth 2: 85-119 and 131-35. New York: National Bureau of Economic Research.

Court, L. (1941a). "Entrepreneurial and Consumer Demand Theories for Commodity Spectra (Part I)." *Econometrica* 9(2): 135-162, April.

Court, L. (1941b). "Entrepreneurial and Consumer Demand Theories for Commodity Spectra (Concluded)." *Econometrica* 9(3/4): 241-297, July-October.

Cunningham, A. (1996). "Measurement Bias in Price Indices: An Application to the UK's RPI." Bank of England, Working Paper Series, No. 47, March.

Dalén, J. (1999). “A Proposal for a New System of Aggregation in the Swedish Consumer Price Index.” Presented at the Fifth Meeting of the International Working Group on Price Indexes, Reykajvik, Iceland, August 25-27.

Deaton, A. (1998). “Getting Prices Right: What Should Be Done?” *Journal of Economic Perspectives* 12(1): 37-46.

Diewert, W. E. and Nakamura, A. O.,eds. (1993). *Essays in Index Number Theory*. Volume 1. New York: North Holland.

Eurostat. (1999). *Compendium of HICP Reference Documents*: Harmonisation of Price Indices. Eurostat, January.

Fisher, F. and Shell, K. (1972). *The Economic Theory of Price Indices: Two Essays on the Effects of Taste, Quality, and Technological Change*. New York: Academic Press.

Fisher, I. (1921). “The Best Form of Index Number.” *Journal of the American Statistical Association* 17: 535-37, March.

Friedman, M. (1938). “Discussion.” Conference on Research in Income and Wealth, Studies in Income and Wealth 2: 123-30. New York: National Bureau of Economic Research.

Gillingham, R. (1983). “Measuring the Cost of Shelter for Homeowners: Theoretical and Empirical Considerations.” *The Review of Economics and Statistics* 65(2): 254-65, May.

Goodhart, C. (Forthcoming). "What weight should be given to asset prices in the measurement of inflation?" *Economic Journal*.

Griliches, Z. (1996). Testimony before the Senate Finance Committee.

Hill, P. (1997). “The Measurement of Inflation and Changes in the Cost of Living.” Prepared for the Conference of European Statisticians, Joint ECE/ILO Meeting on Consumer Price Indices, Geneva, November 24-27.

Hill, P. (1999). “Inflation, the Cost of Living and the Domain of a Consumer Price Index.” Prepared for the Conference of European Statisticians, Joint ECE/ILO Meeting on Consumer Price Indices, Geneva, November 3-5.

Hoffmann, J. (1998). *Problems of Inflation Measurement in Germany*. Frankfurt, Germany: Deutsche Bundesbank.

Holloway, S. (1999). “Where Is the RPI on the Pure Price Index--Cost-of-Living Continuum?” Unpublished paper, January 20.

Hulten, C. (1973). “Divisia Index Numbers.” *Econometrica* 41(6): 1017-25, November.

Ironmonger, D.S. (1972). *New Commodities and Consumer Behavior*. *University of Cambridge, Department of Applies Economics Monographs* 20. Cambridge: Cambridge University Press.

Konus, A. A. (1939). "The Problem of the True Index of the Cost of Living." *Econometrica* 7 (January): 10-29.

Krugman, P. (1998). *The Accidental Theorist: and Other Dispatches from the Dismal Science*. Norton, 1998.

Lancaster, K. J. (1971). *Consumer Demand: A New Approach*. New York: Columbia University Press.

Lebow, D. E., Roberts, J. M., and Stockton, D. J. (1994). "Monetary Policy and 'The Price Level.'" Washington, DC, Board of Governors of the Federal Reserve System.

Manser, M. E. and McDonald, R. J. (1988). "An Analysis of Substitution Bias in Measuring Inflation, 1959-85." *Econometrica* (July): 909-30.

Organisation for Economic Co-operation and Development. (1997). "Synthesis Paper on Shortcomings of the Consumer Price Index Measure of Inflation for Economic Policy Purposes." Prepared at the request of the Economic Policy Committee at its meeting of December 1996.

Oulton, N. (1995). "Do UK Price Indexes Overstate Inflation?" *National Institute Economic Review* 0(152): 60-75.

Pakes, A. (1997). "New Goods, Characteristic Based Models, and the Role of Hedonics." Unpublished paper. Yale University.

Pollak, R. A. (1989). *The Theory of the Cost of Living Index*. New York: Oxford University Press.

Pollak, R. A. (1998). "The Consumer Price Index: A Research Agenda and Three Proposals." *Journal of Economic Perspectives* 12(1): 69-78, Winter.

Randolph, W. C. (1988). "Housing Depreciation and Aging Bias in the Consumer Price Index." *Journal of Business and Economic Statistics* (July): 359-71.

Ruiz-Castillo, J., Ley, E., and Izquierdo, M. (2000). "The Laspeyres Bias in the Spanish Consumer Price Index." Working Paper, Fundacion de Estudios de Economia Aplicada (FEDEA). Madrid, Spain.

Shapiro, M. D. and Wilcox, D. (1996). "Measurement in the Consumer Price Index: An Evaluation." *National Bureau of Economic Research Working Paper* 5590 (May).

Shiratsuka, S. (1998). "Measurement Errors in Japanese Consumer Price Index." Prepared for the Bank of Japan and the Federal Reserve Bank of Chicago, June.

Statistics Canada. (1995). *The Consumer Price Index Reference Paper*. Ottawa, Canada: Minister of Industry, July.

Stigler, G. J. (1961). “The Economics of Information.” *The Journal of Political Economy* 69(3): 213-225.

Stott, H. (1998). “The CPI Purpose and Definition--The Australasian Debate.” In *Proceedings of the Fourth Meeting of the International Working Group on Price Indices*, edited by Walter Lane. Washington, DC: Department of Labor.

Thaler, R. H. (1991). *Quasi Rational Economics*. New York: Russell Sage Foundation, 1991.

Triplett, J. E. (1983a). "Escalation Measures: What is the Answer? What is the Question?” In *Price Level Measurement*, edited by W. Erwin Diewert and C. Monmarquette. Ottawa, Canada: Minister of Supply and Services Canada, 457-82.

Triplett, J. E. (1983b). “Concepts of Quality in Input and Output Price Measures: A Resolution of the User-Value Resource-Cost Debate.” In Murray F. Foss, ed., The U.S. National Income and Product Accounts: Selected Topics. National Bureau of Economic Research, Studies in Income and Wealth, vol. 47. Chicago: The University of Chicago Press.

Triplett, J. E. (1987). "Hedonic Functions and Hedonic Indexes." In John Eatwell, Murray Milgate, and Peter Newman, eds. *The New Palgrave: A Dictionary of Economics*. New York: Stockton Press, 630 34.

Triplett, J. E. (1998). “Elementary Indexes for a Consumer Price Index.” In *Proceedings of the Fourth Meeting of the International Working Group on Price Indices*, edited by Walter Lane. Washington, DC: Department of Labor.

Turvey, R. (1989). *Consumer Price Indices*. Geneva: International Labour Organisation.

Turvey, R. (1999). “True Cost of Living Indexes.” Proceedings of the Ottawa Group, Fifth Meeting, obtainable electronically from: www.statice.is (or from Statistics Iceland, Skuggasund 3, IS-150, Reykajvík, Iceland).

United States Department of Labor, Bureau of Labor Statistics. (1997). “Chapter 5. Published Estimates of Consumer Price Elasticities of Demand.” In “The Use of the Geometric Mean in the Elementary Indexes of the Consumer Price Index.” Unpublished BLS study.

Walsh, C.M. (1921). “The Best Form of Index Number: Discussion.” *Journal of the American Statistical Association* 17: 537-44, March.

Wynne, M. A. and Sigalla, F. (1993). “A Survey of Measurement Biases in Price Indexes.” *Federal Reserve Bank of Dallas* Research Paper 9340, October.

Endnotes

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[2] Hill (1999) contends that this definition of the COL index differs from that of Pollak (1989), apparently because it contains the words "price index." I do not comprehend any difference from definition, except in choice of words, and do not intend a different definition. I consider in section 3 Hill's (1997) remarkable assertion that the COL index is not a price index.

[3] The key words are "by design." Obviously, one lacks the ability to control exactly for changes in the standard of living. That is also precisely equivalent to saying that one can not estimate exactly a COL index.

[4] That has also been described as a theory that predicts little that is not obvious. But its implications are evidently not obvious to non-economists. Politicians and policy makers are often subsequently surprised when price effects actually influence consumers' behaviors in ways not considered when policies were adopted. Some entertaining and instructive examples appear in Krugman (1998).

[5] The US CPI identifies approximately 200 commodities for which component price indexes are calculated and weights are assigned, the French CPI approximately 600. The Australian CPI has something on the order of 1,500 commodities.

[6] The name "pure price index" has been around for a very long time. But no one has ever written down very clearly what a pure price index was supposed to mean, except when it was identified with the Laspeyres or other fixed-weight weighting system (this is Hill's, 1997, 1999 definition). "Pure price index"

has also been used to mean that the index is quality adjusted (an “impure” index on this usage has quality error in it).

[7] The issue discussed in this section is a very old one, and will be familiar to almost anyone who has worked on price indexes. I am not sure, however, just where this matter is written down, if anywhere. It was brought back to my attention in a recent conversation with Angus Deaton, Robert Pollak, and Charles Schultze.